Fig.1 (a)

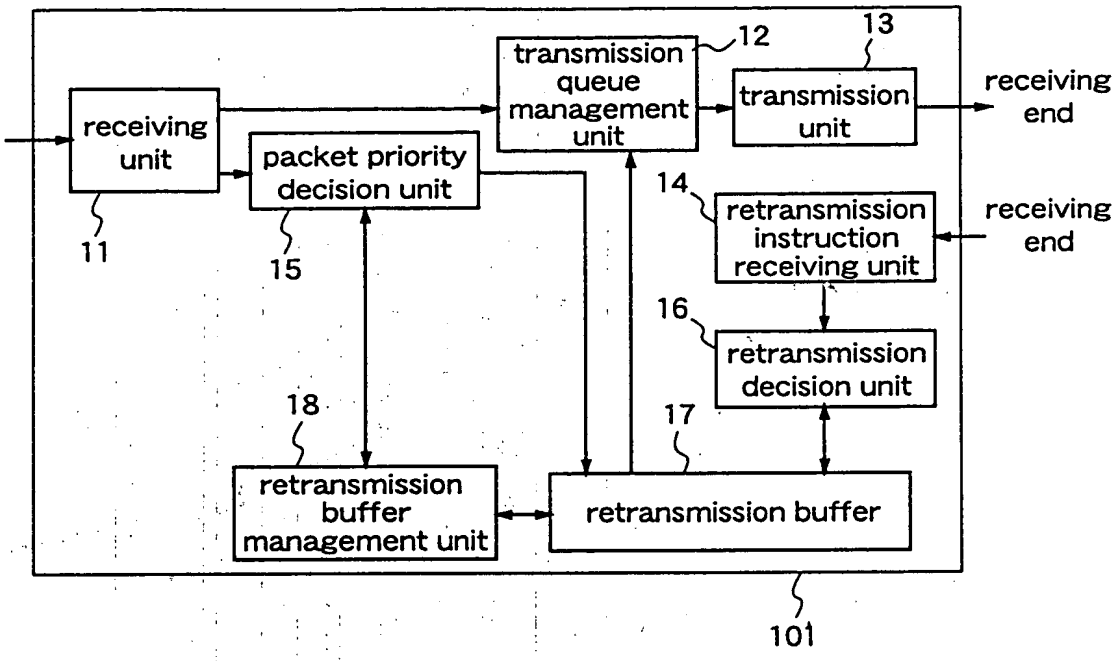


Fig.1 (b)

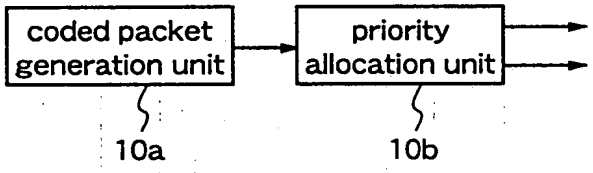


Fig.2

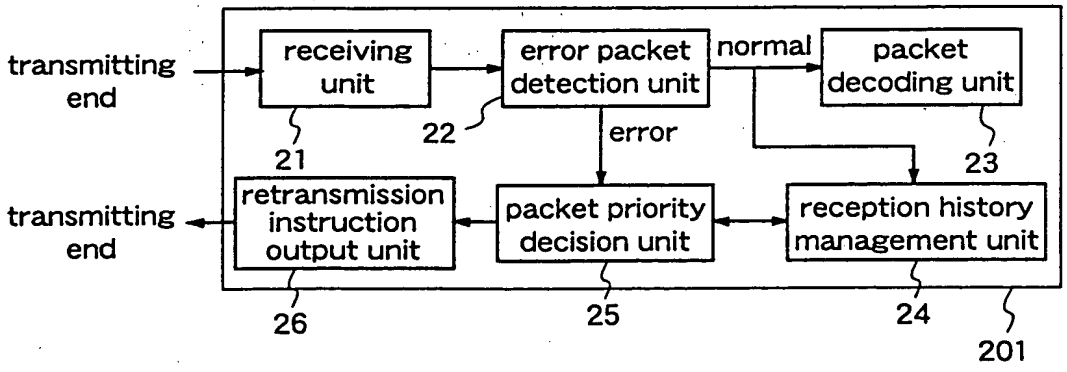


Fig.3

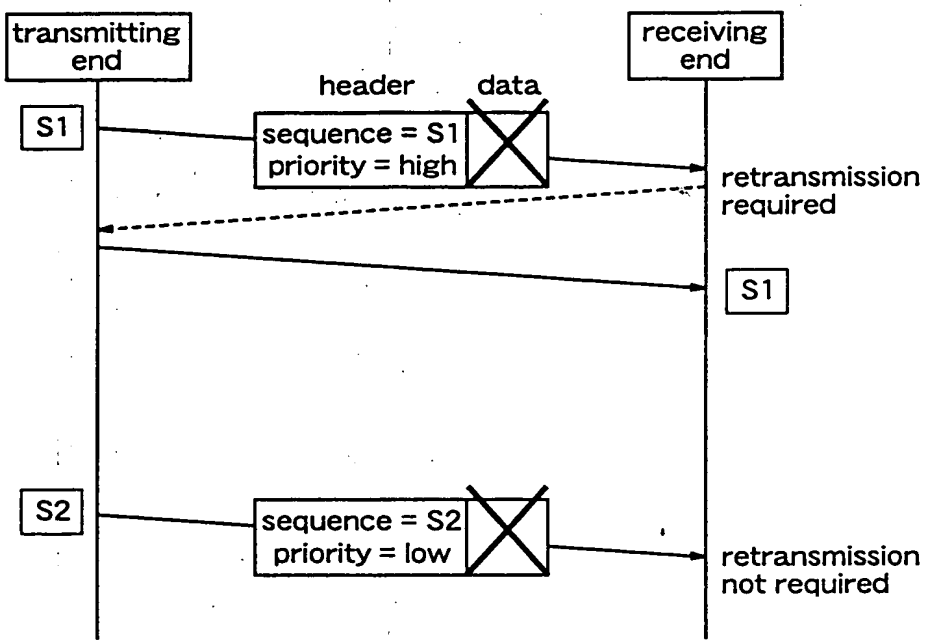

transmitting end
receiving end
header
data
S1
sequence = S1
priority = high
retransmission required
S1
S2
sequence = S2
priority = low
retransmission not required

Fig.4

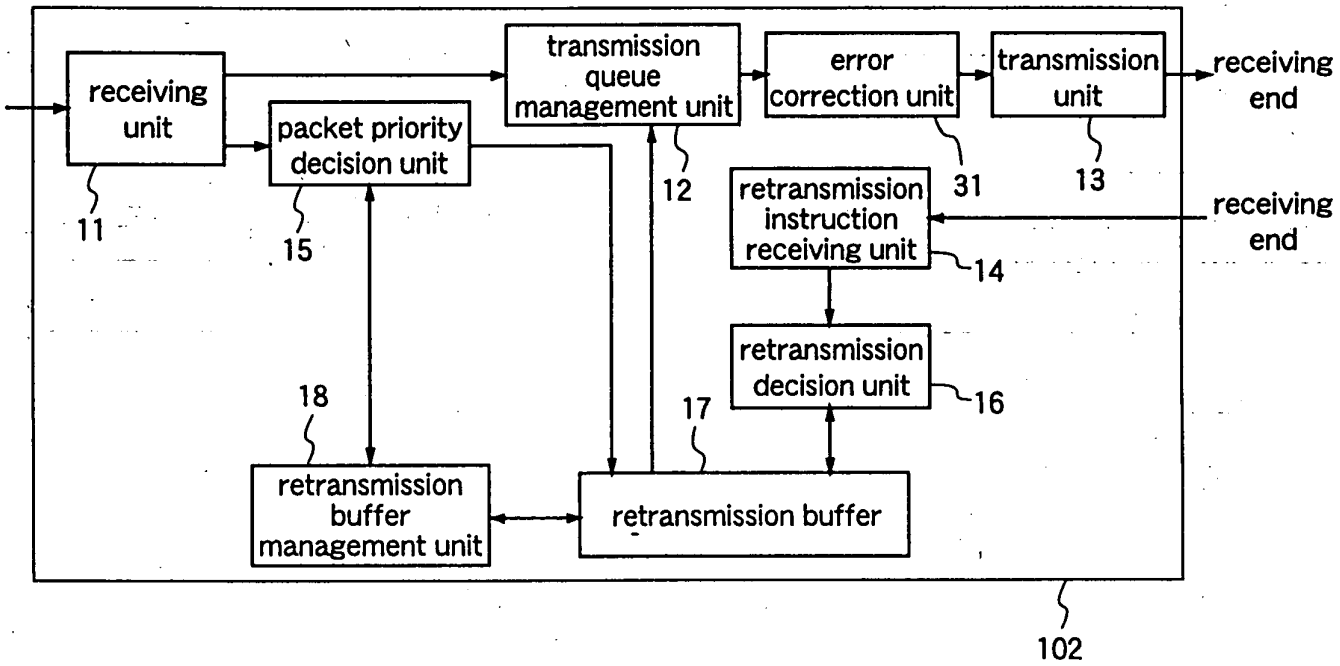

receiving unit
11
packet priority decision unit
15
transmission queue management unit
12
error correction unit
31
transmission unit
13
receiving end
retransmission instruction receiving unit
14
receiving end
retransmission decision unit
16
17
18
retransmission buffer management unit
retransmission buffer
102

Fig.5

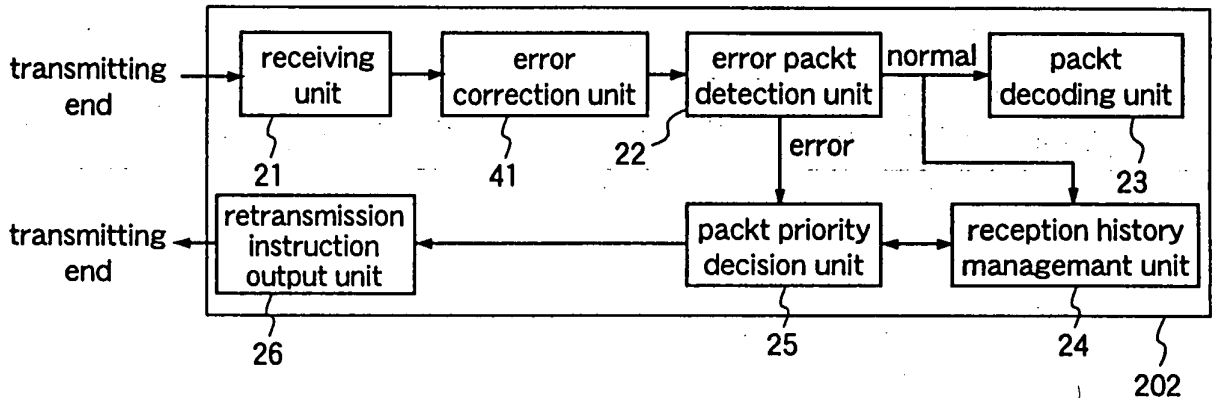

transmitting end
receiving unit
error correction unit
error packt detection unit
normal
packt decoding unit
21
41
22
error
23
transmitting end
retransmission instruction output unit
packt priority decision unit
reception history managemant unit
26
25
24
202

Fig.6

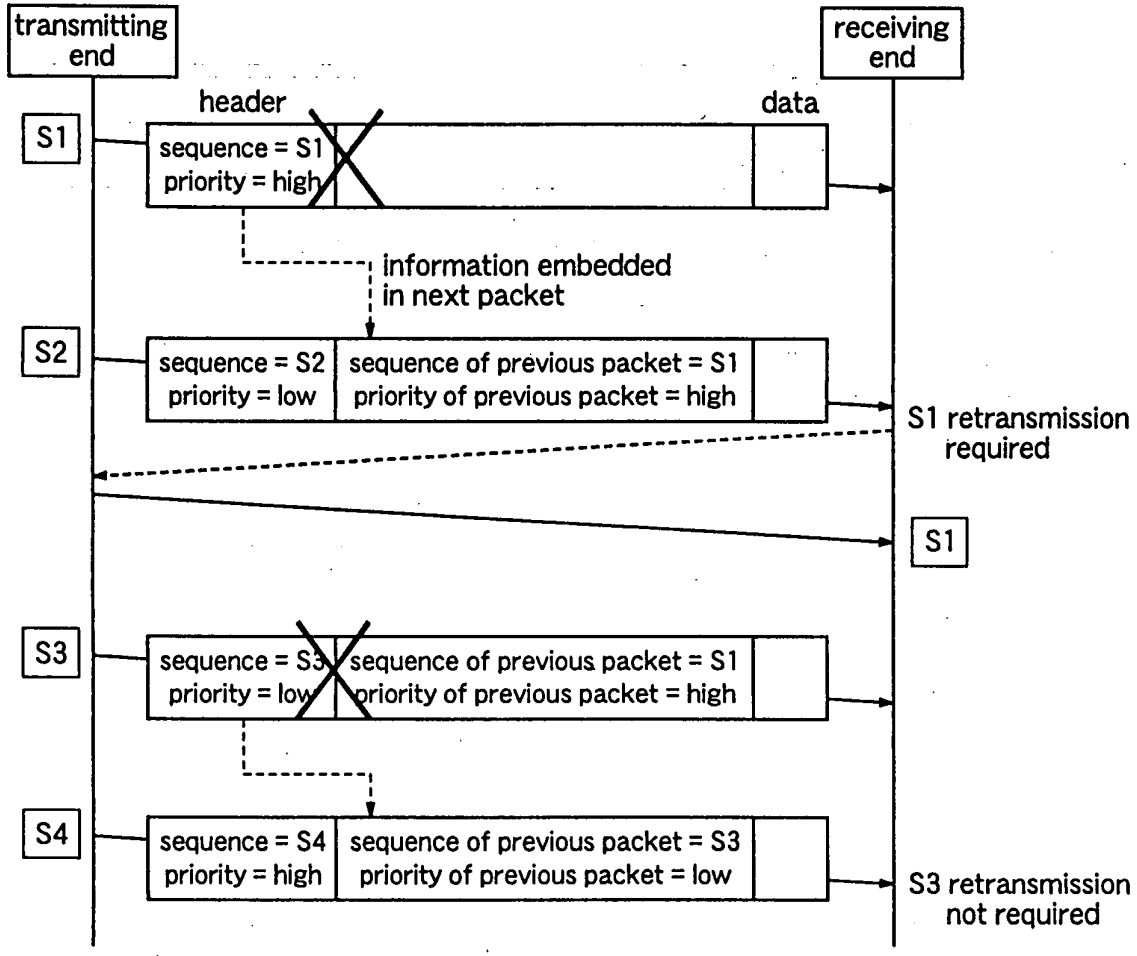

transmitting end
receiving end
header
data
S1
sequence = S1
priority = high
information embedded in next packet
S2
sequence = S2
priority = low
sequence of previous packet = S1
priority of previous packet = high
S1 retransmission required
S1
S3
sequence = S3
priority = low
sequence of previous packet = S1
priority of previous packet = high
S4
sequence = S4
priority = high
sequence of previous packet = S3
priority of previous packet = low
S3 retransmission not required

Fig.7

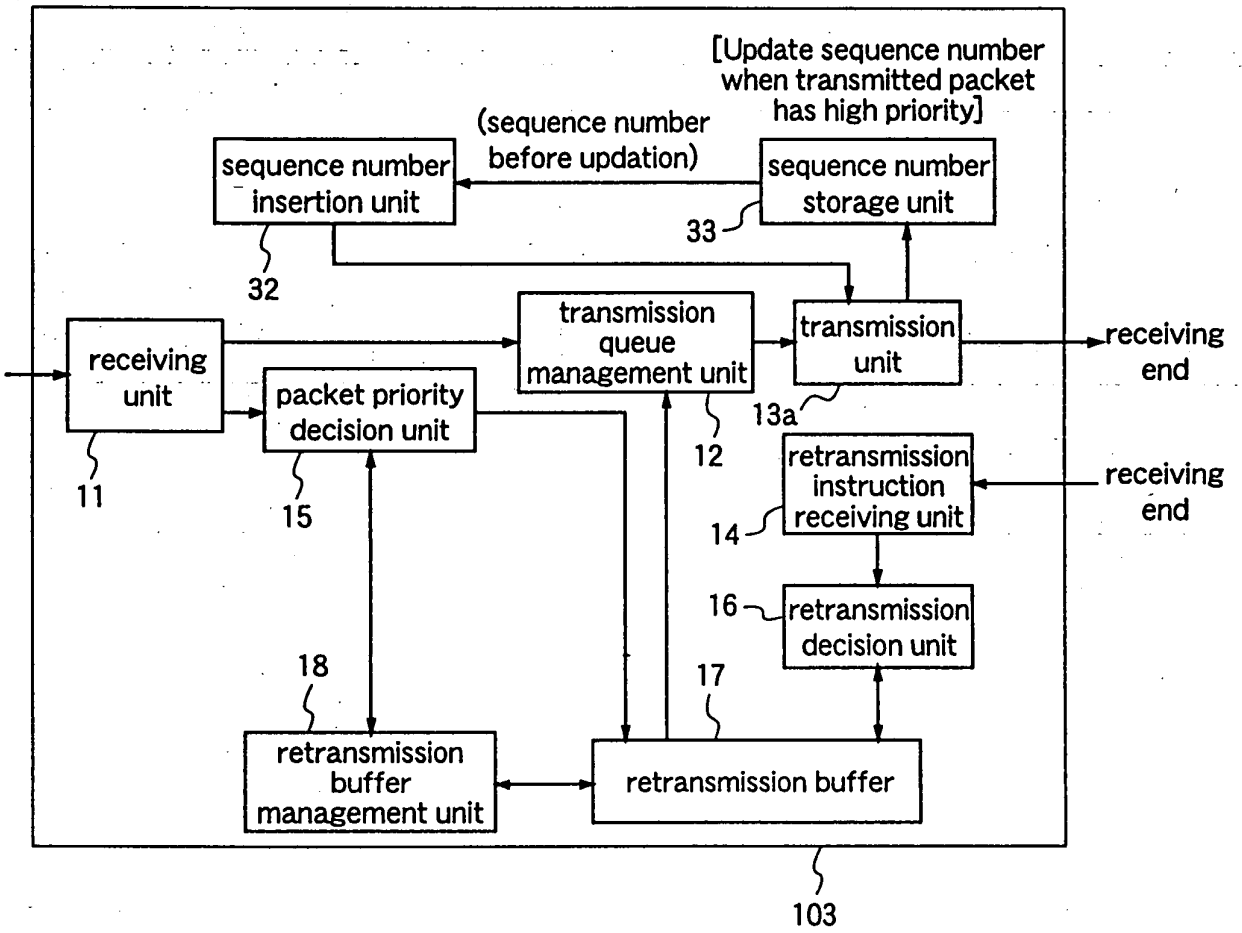

[Update sequence number when transmitted packet has high priority]
(sequence number before updation)
sequence number insertion unit
sequence number storage unit
33
32
receiving unit
transmission queue management unit
transmission unit
receiving end
packet priority decision unit
13a
12
11
15
retransmission instruction receiving unit
receiving end
14
16
retransmission decision unit
18
17
retransmission buffer management unit
retransmission buffer
103

Fig.8

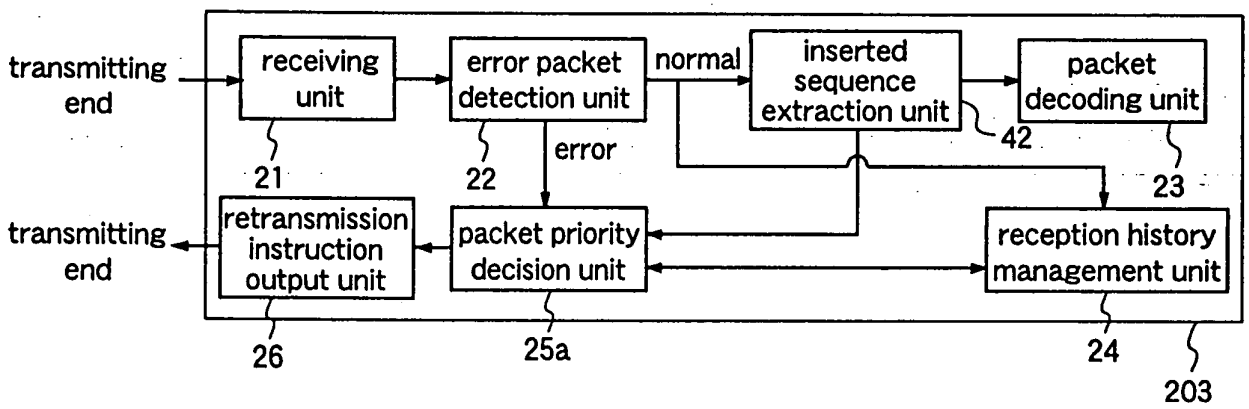

transmitting end
receiving unit
error packet detection unit
normal
inserted sequence extraction unit
packet decoding unit
42
21
22
error
23
transmitting end
retransmission instruction output unit
packet priority decision unit
reception history management unit
26
25a
24
203

Fig.9

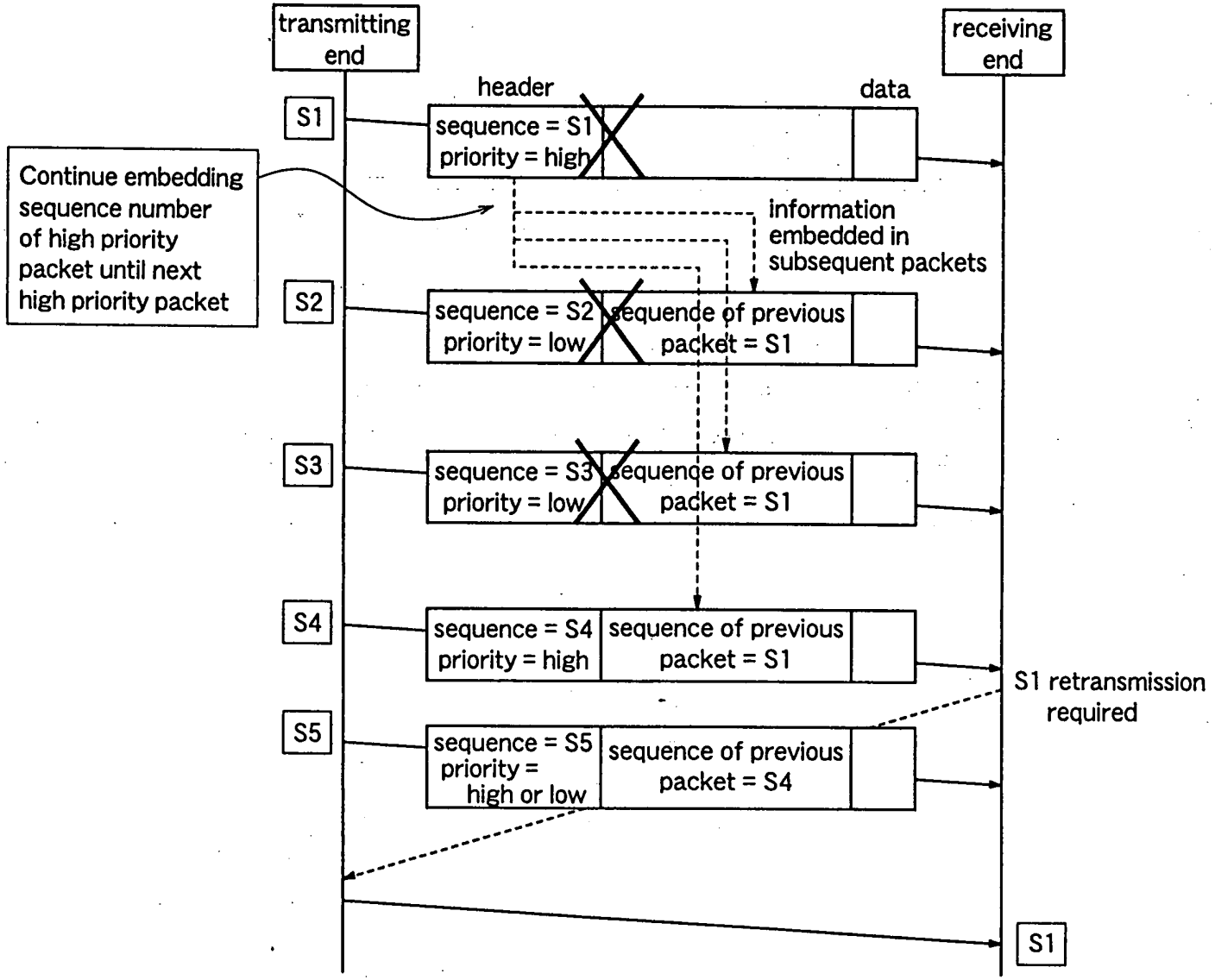

transmitting end
receiving end
header
data
S1
sequence = S1
priority = high
Continue embedding sequence number of high priority packet until next high priority packet
information embedded in subsequent packets
S2
sequence = S2
priority = low
sequence of previous packet = S1
S3
sequence = S3
priority = low
sequence of previous packet = S1
S4
sequence = S4
priority = high
sequence of previous packet = S1
S1 retransmission required
S5
sequence = S5
priority = high or low
sequence of previous packet = S4
S1

Fig.10

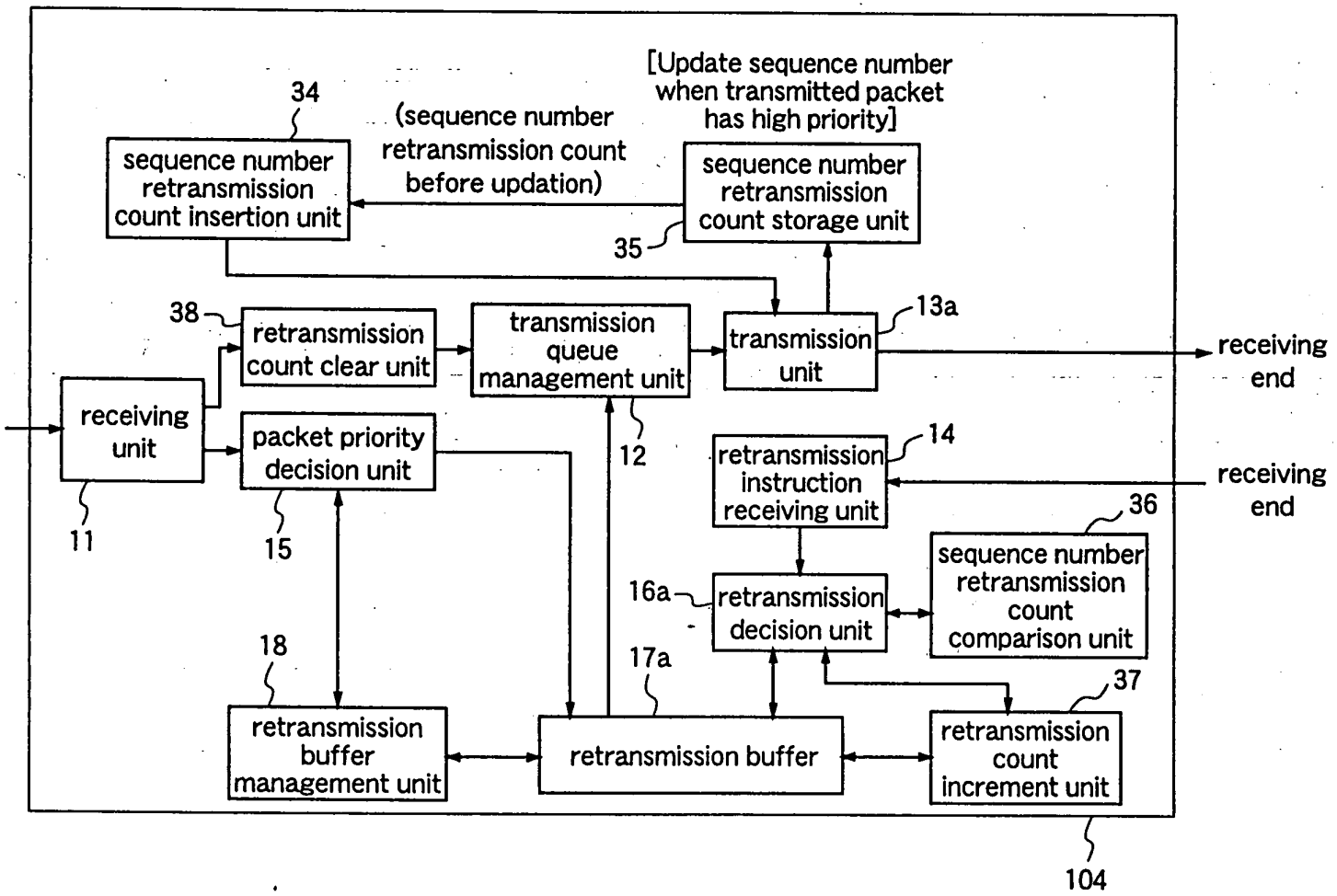

[Update sequence number when transmitted packet has high priority]
34
(sequence number retransmission count before updation)
sequence number retransmission count insertion unit
sequence number retransmission count storage unit
35
38
retransmission count clear unit
transmission queue management unit
transmission unit
13a
receiving end
receiving unit
packet priority decision unit
12
retransmission instruction receiving unit
14
receiving end
11
15
36
sequence number retransmission count comparison unit
16a
retransmission decision unit
18
17a
37
retransmission buffer management unit
retransmission buffer
retransmission count increment unit
104

Fig.11

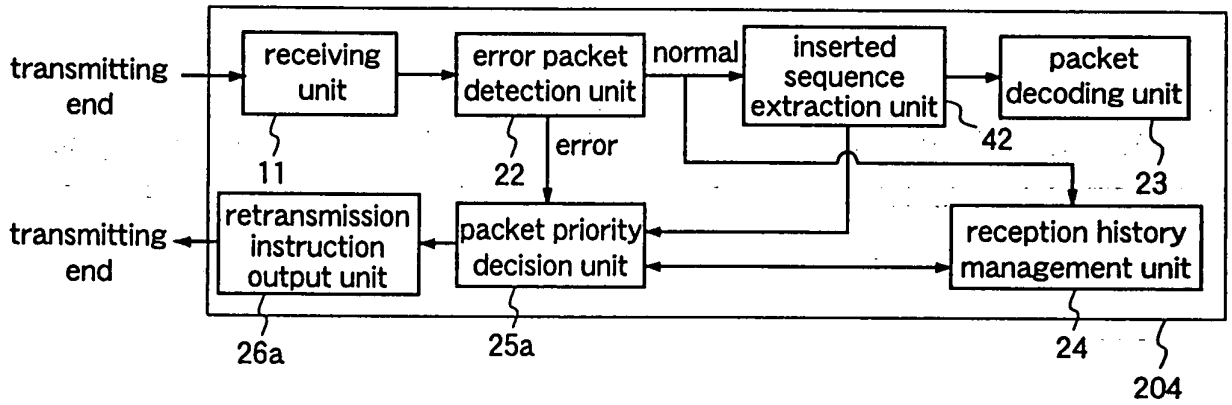

transmitting end
receiving unit
error packet detection unit
normal
inserted sequence extraction unit
packet decoding unit
11
22
error
42
23
transmitting end
retransmission instruction output unit
packet priority decision unit
reception history management unit
26a
25a
24
204

Fig.12

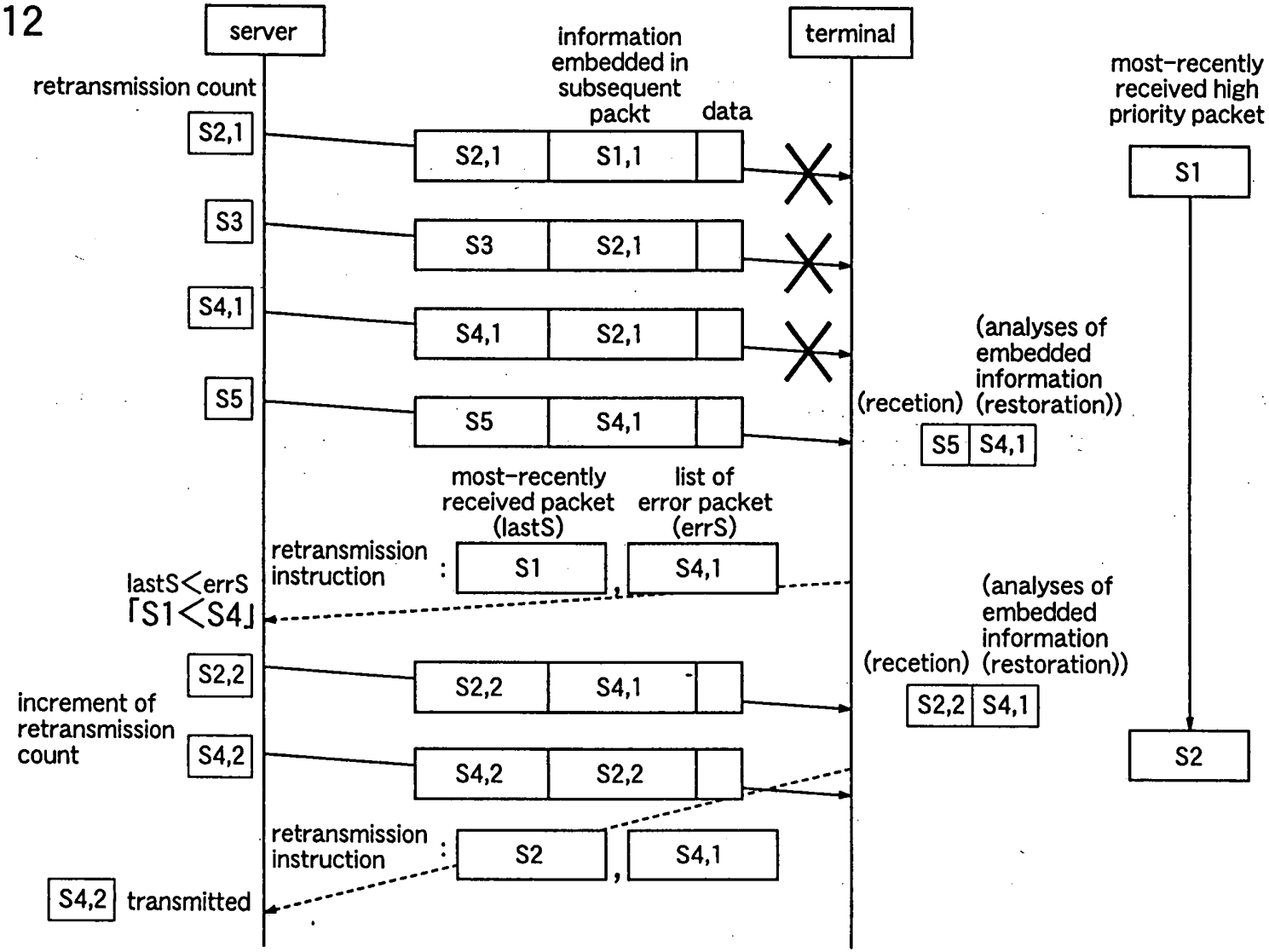

server
terminal
retransmission count
information embedded in subsequent packt
data
most-recently received high priority packet
S2,1
S1,1
S1
S3
S2,1
S4,1
S2,1
(recetion)
(analyses of embedded information (restoration))
S5
S4,1
S5
S4,1
most-recently received packet (lastS)
list of error packet (errS)
retransmission instruction
S1
S4,1
lastS<errS
「S1<S4」
S2,2
S2,2
S4,1
increment of retransmission count
S4,2
S4,2
S2,2
S2
retransmission instruction
S4,2 transmitted

Fig.13

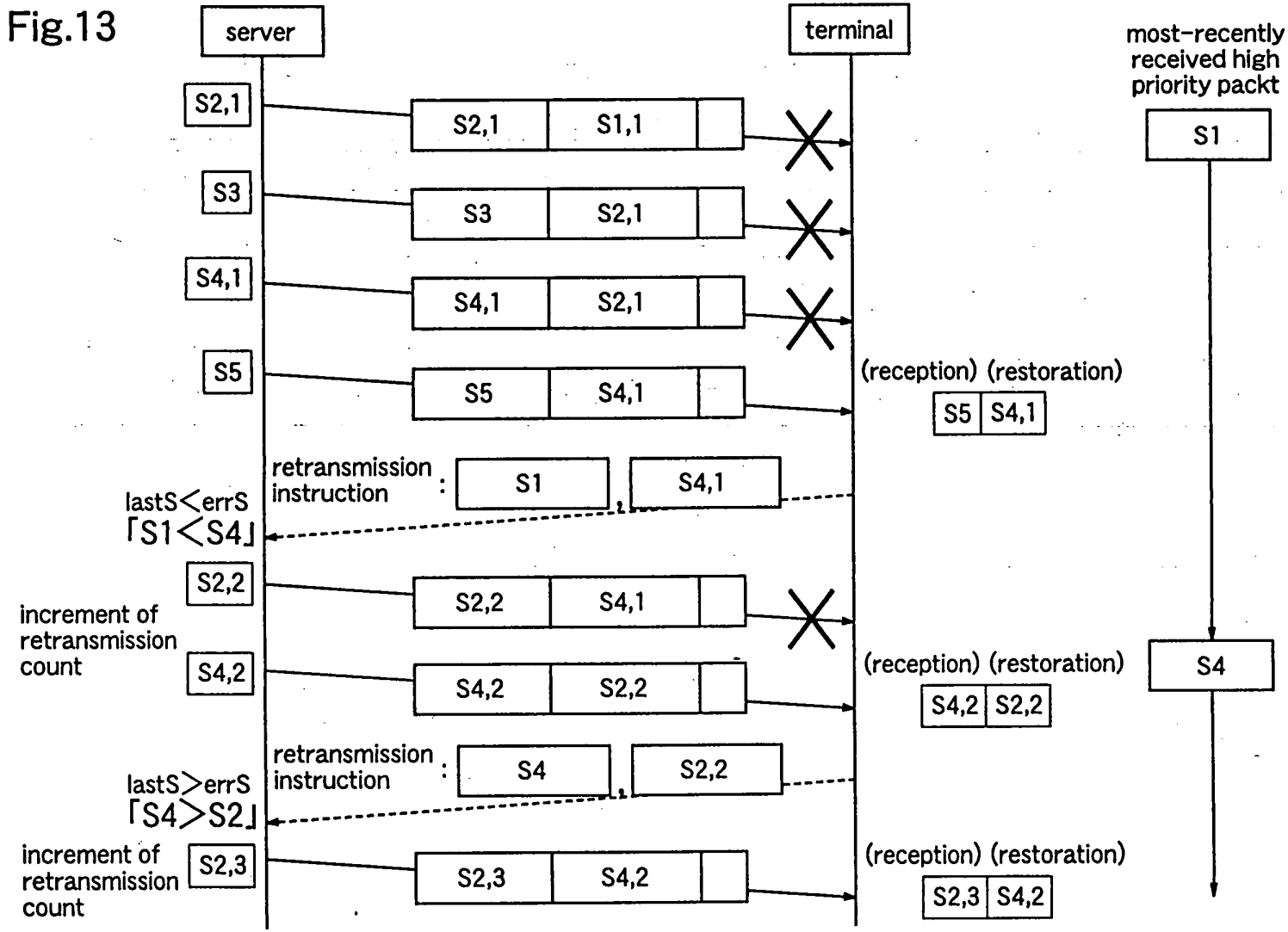

server
terminal
most-recently received high priority packt
S1
S2,1
S2,1 S1,1
S3
S3 S2,1
S4,1
S4,1 S2,1
S5
S5 S4,1
(reception) (restoration)
S5 S4,1
retransmission instruction :
S1 S4,1
lastS<errS
「S1<S4」
S2,2
S2,2 S4,1
increment of retransmission count
S4,2
S4,2 S2,2
(reception) (restoration)
S4,2 S2,2
S4
retransmission instruction :
S4 S2,2
lastS>errS
「S4>S2」
increment of retransmission count
S2,3
S2,3 S4,2
(reception) (restoration)
S2,3 S4,2

Fig.14

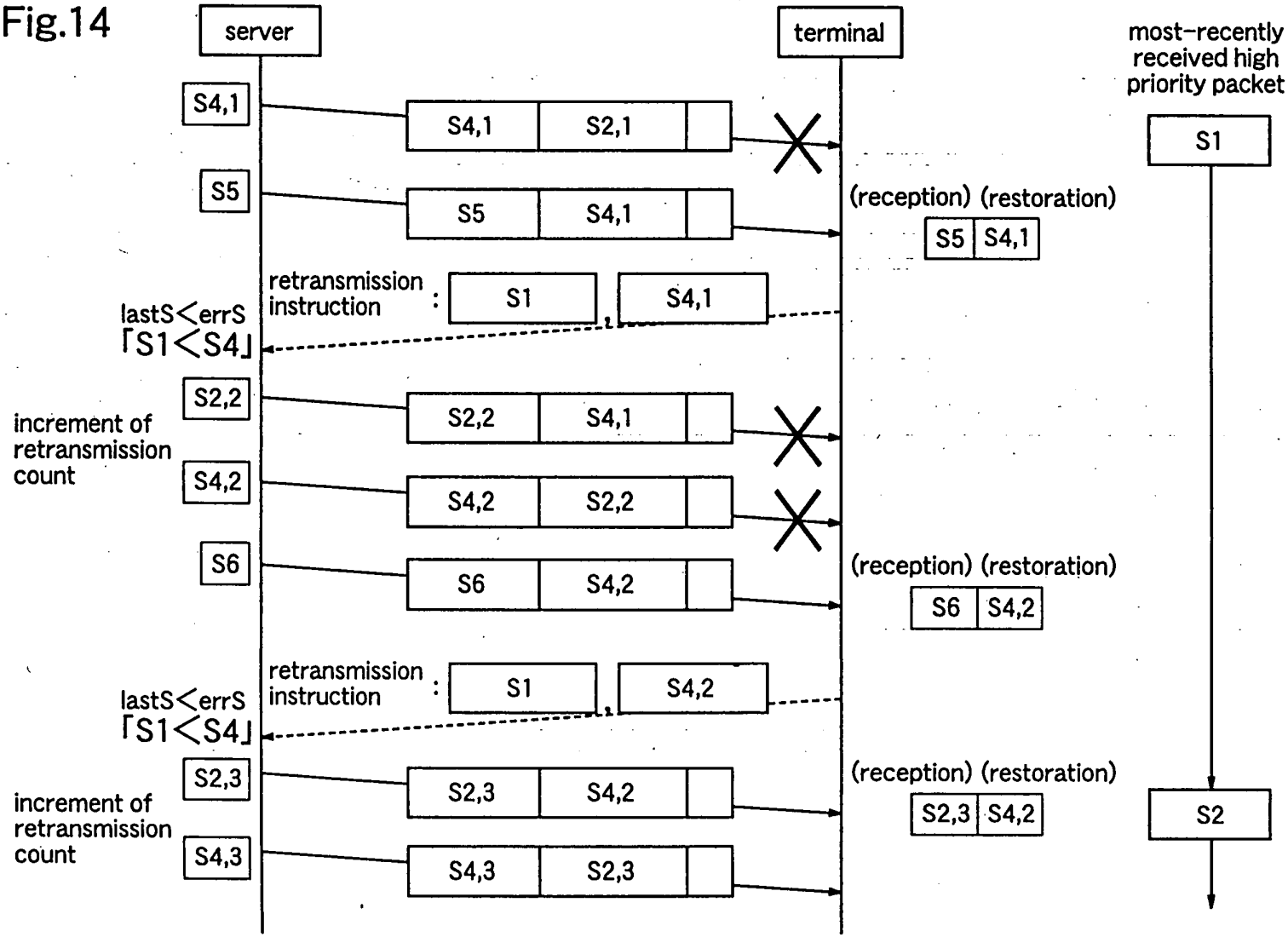

server
terminal
most-recently received high priority packet
S4,1
S4,1
S2,1
S5
S5
S4,1
(reception) (restoration)
S5
S4,1
S1
retransmission instruction :
S1
S4,1
lastS<errS
「S1<S4」
S2,2
S2,2
S4,1
increment of retransmission count
S4,2
S4,2
S2,2
S6
S6
S4,2
(reception) (restoration)
S6
S4,2
retransmission instruction :
S1
S4,2
lastS<errS
「S1<S4」
S2,3
S2,3
S4,2
(reception) (restoration)
S2,3
S4,2
increment of retransmission count
S4,3
S4,3
S2,3
S2

Fig.15

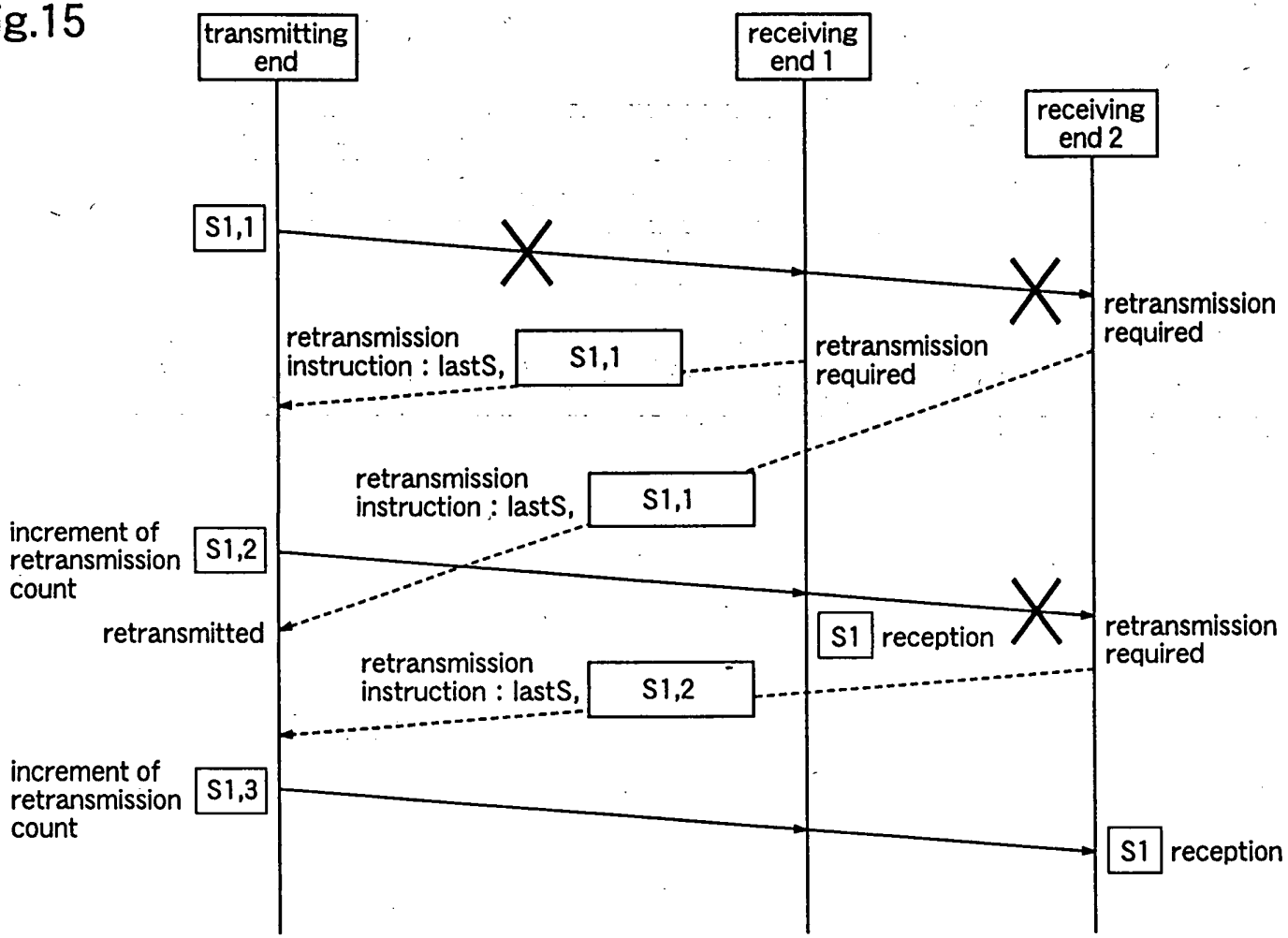

transmitting end
receiving end 1
receiving end 2
S1,1
retransmission required
retransmission instruction : lastS,
S1,1
retransmission required
retransmission instruction : lastS,
S1,1
increment of retransmission count
S1,2
retransmitted
S1 reception
retransmission required
retransmission instruction : lastS,
S1,2
increment of retransmission count
S1,3
S1 reception

Fig.16 (a)

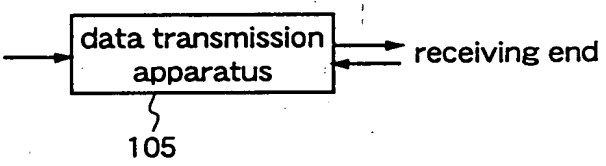


Fig.16 (b)

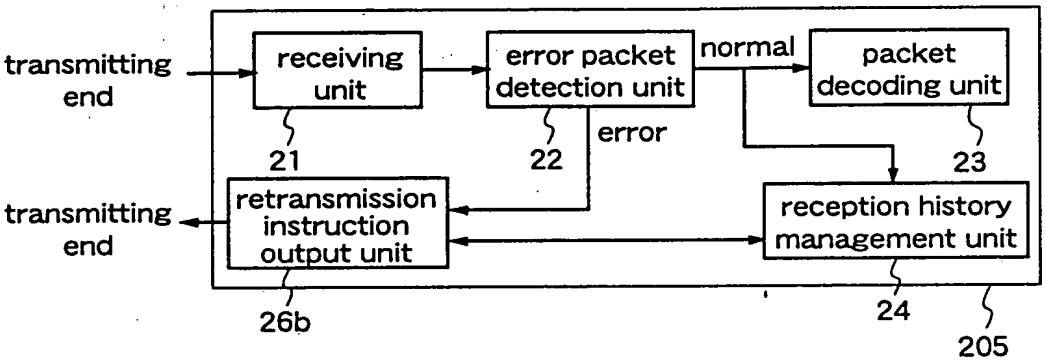


Fig.17

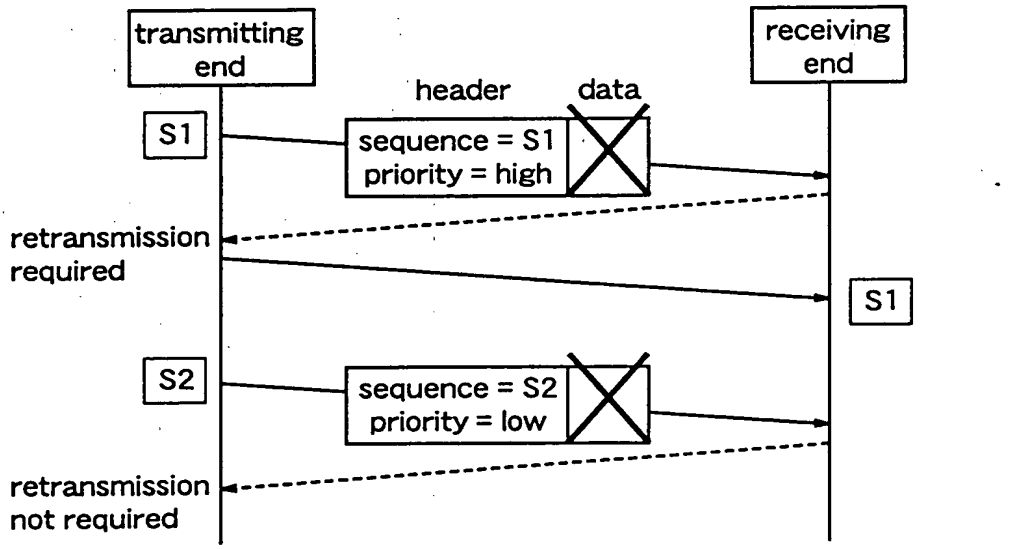


Fig.18

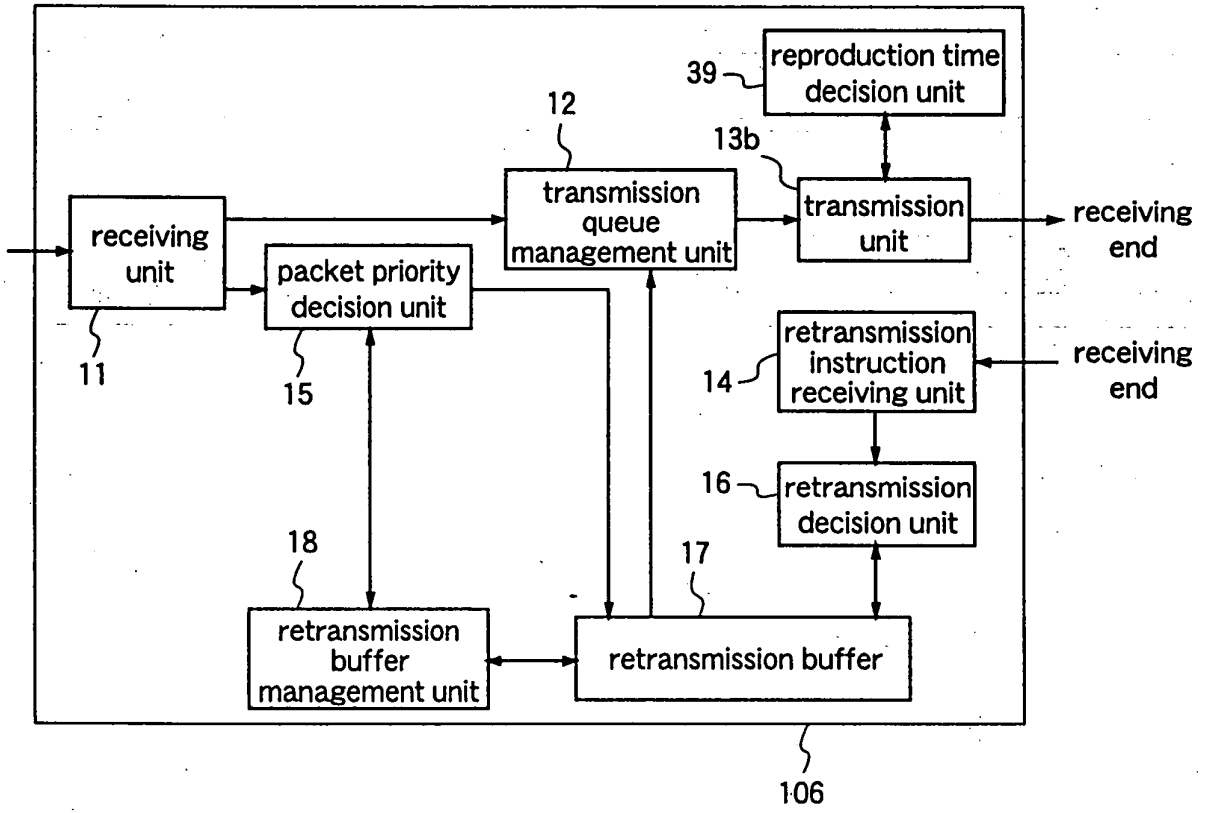

reproduction time decision unit
39
12
13b
transmission queue management unit
transmission unit
receiving end
receiving unit
packet priority decision unit
11
15
retransmission instruction receiving unit
14
receiving end
16
retransmission decision unit
18
17
retransmission buffer management unit
retransmission buffer
106

Fig.19

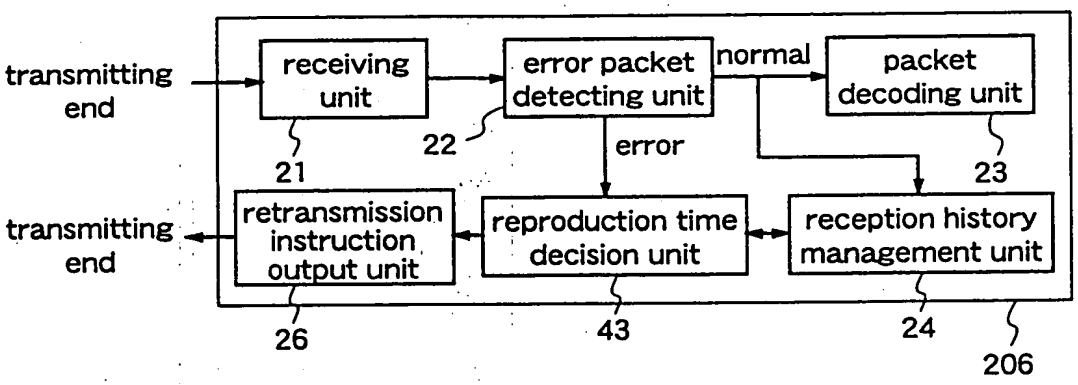

transmitting end
receiving unit
21
error packet detecting unit
22
normal
packet decoding unit
23
error
transmitting end
retransmission instruction output unit
26
reproduction time decision unit
43
reception history management unit
24
206

Fig.20

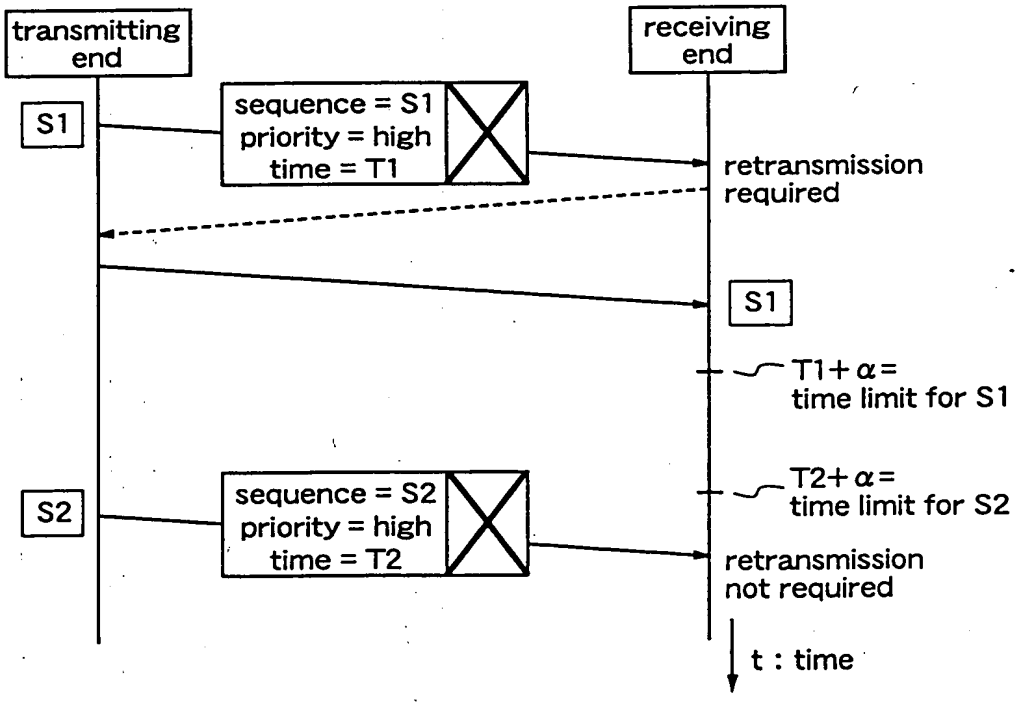

transmitting end
receiving end
S1
sequence = S1
priority = high
time = T1
retransmission required
S1
T1+α=
time limit for S1
S2
sequence = S2
priority = high
time = T2
T2+α=
time limit for S2
retransmission not required
t : time

Fig.21

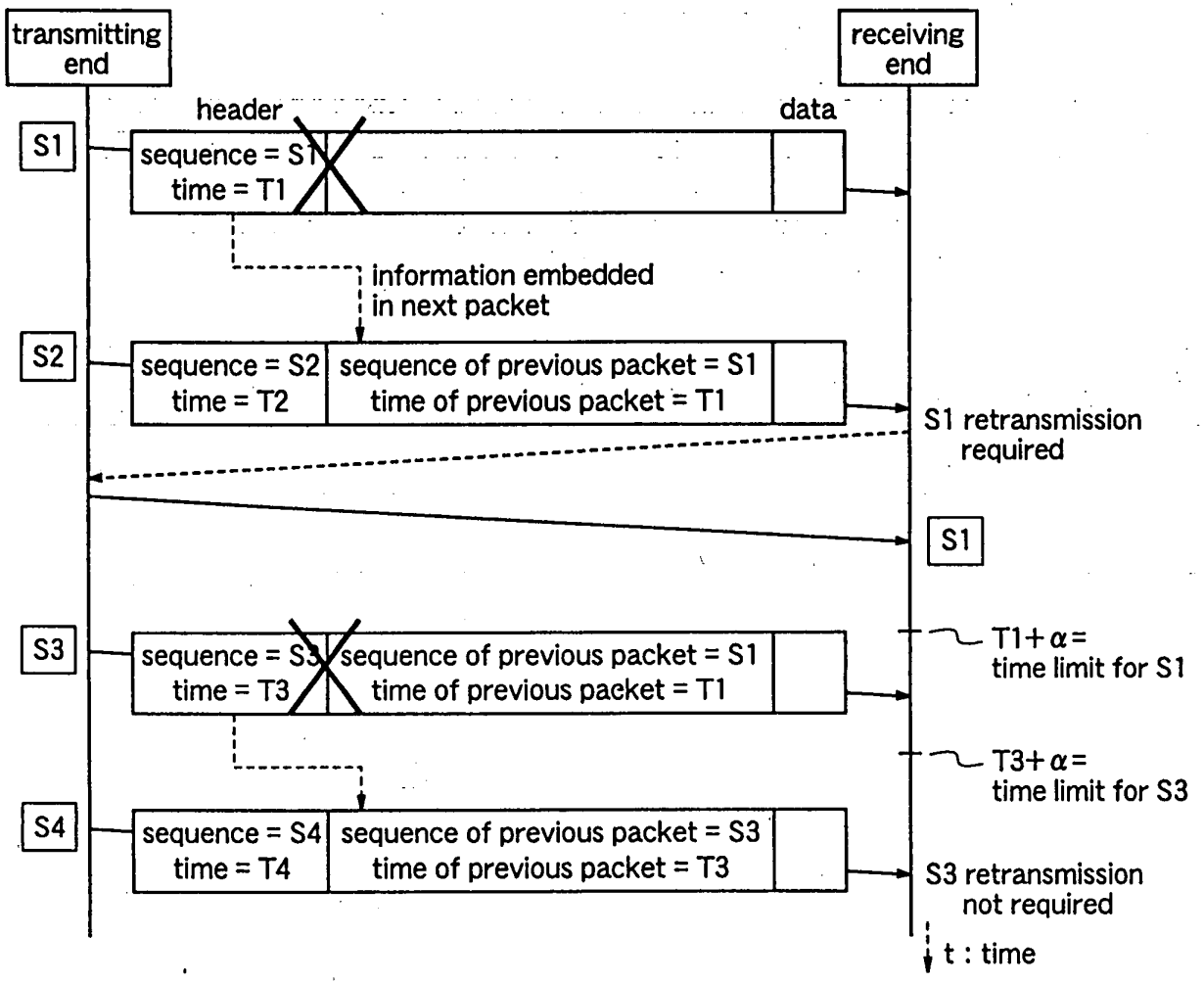

transmitting end
receiving end
header
data
S1
sequence = S1
time = T1
information embedded in next packet
S2
sequence = S2
time = T2
sequence of previous packet = S1
time of previous packet = T1
S1 retransmission required
S1
S3
sequence = S3
time = T3
sequence of previous packet = S1
time of previous packet = T1
T1+α= time limit for S1
T3+α= time limit for S3
S4
sequence = S4
time = T4
sequence of previous packet = S3
time of previous packet = T3
S3 retransmission not required
t : time

Fig.22

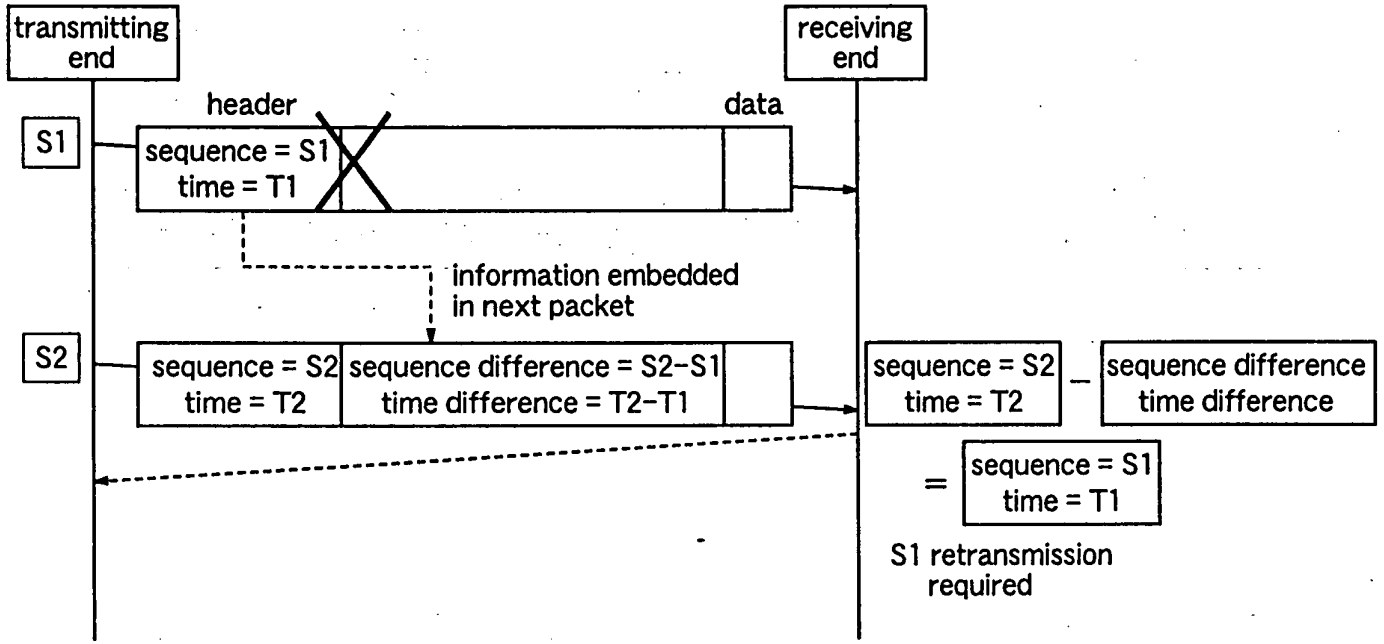

transmitting end
receiving end
header
data
S1
sequence = S1
time = T1
information embedded in next packet
S2
sequence = S2
time = T2
sequence difference = S2-S1
time difference = T2-T1
sequence = S2
time = T2
sequence difference
time difference
=
sequence = S1
time = T1
S1 retransmission required

Fig.23

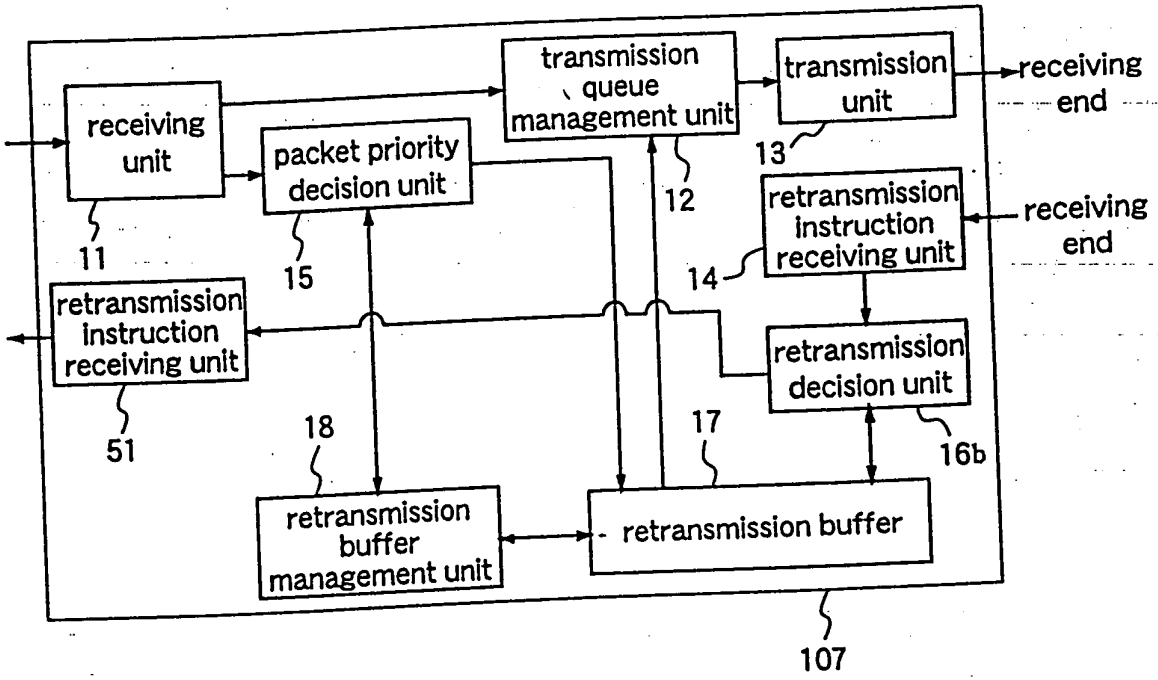

receiving unit
packet priority decision unit
transmission queue management unit
transmission unit
receiving end
retransmission instruction receiving unit
receiving end
retransmission instruction receiving unit
retransmission decision unit
retransmission buffer management unit
retransmission buffer
11
15
12
13
14
51
18
17
16b
107

Fig.24

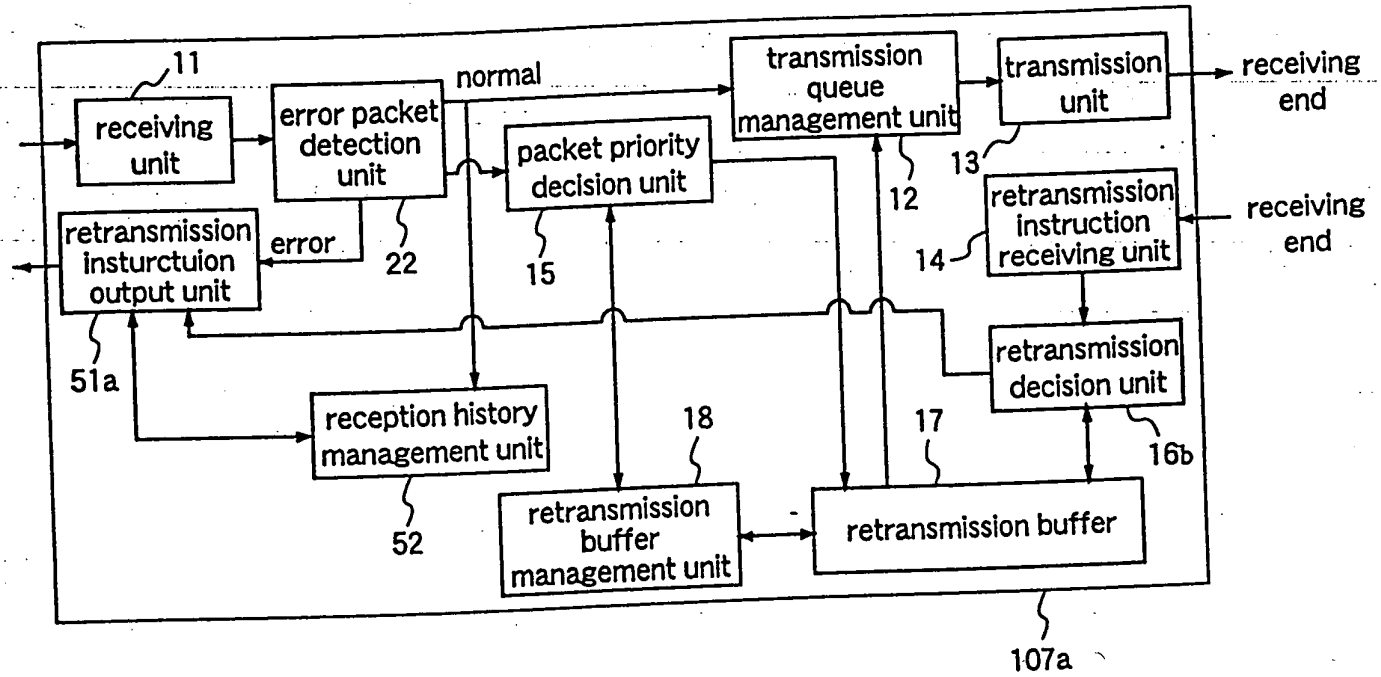

11
receiving unit
error packet detection unit
normal
transmission queue management unit
transmission unit
receiving end
packet priority decision unit
13
12
retransmission instruction receiving unit
receiving end
retransmission insturctuion output unit
error
22
15
14
retransmission decision unit
51a
reception history management unit
18
17
16b
52
retransmission buffer management unit
retransmission buffer
107a

Fig.25

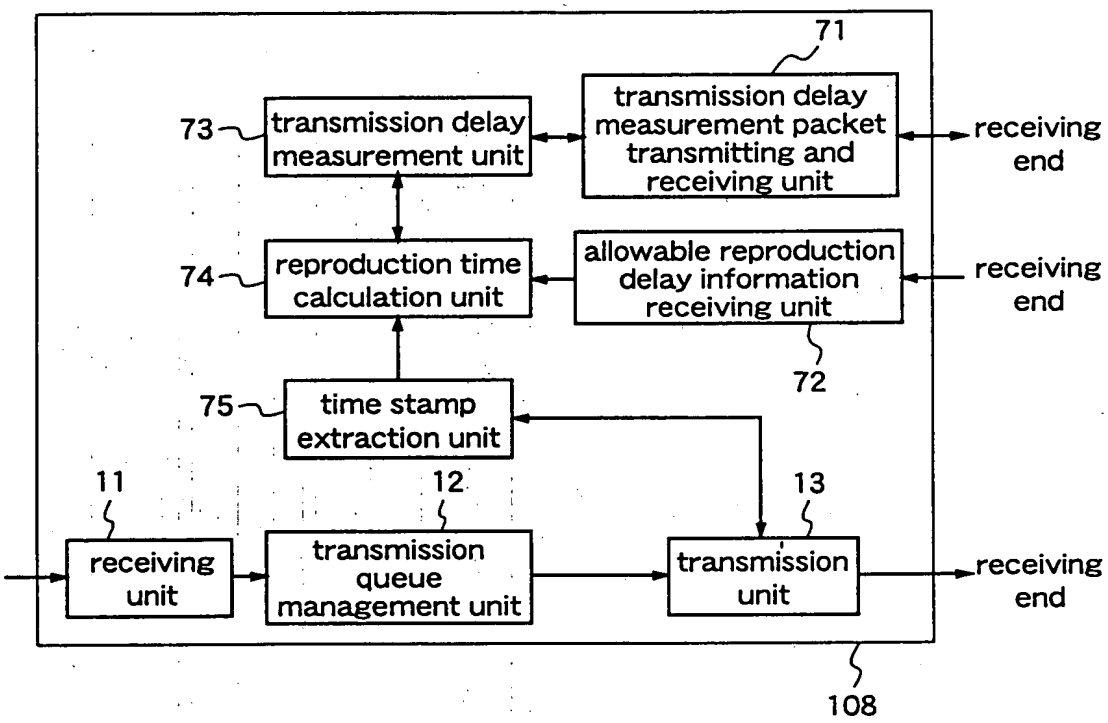

71
transmission delay measurement packet transmitting and receiving unit
receiving end
73
transmission delay measurement unit
74
reproduction time calculation unit
allowable reproduction delay information receiving unit
receiving end
72
75
time stamp extraction unit
11
12
13
receiving unit
transmission queue management unit
transmission unit
receiving end
108

Fig.26

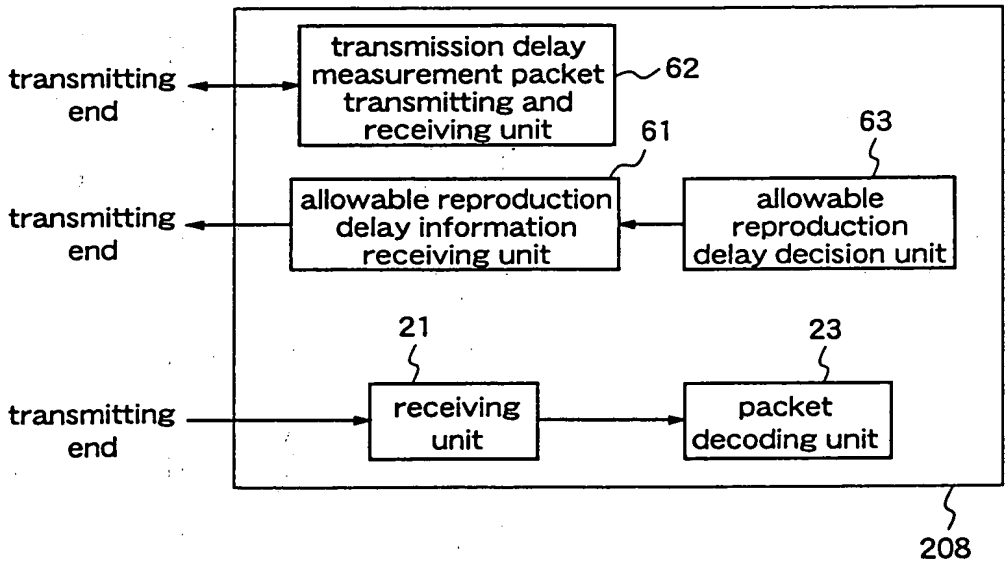
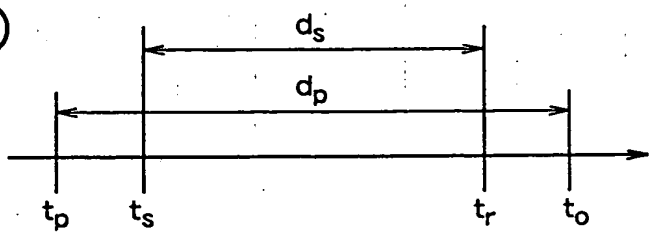
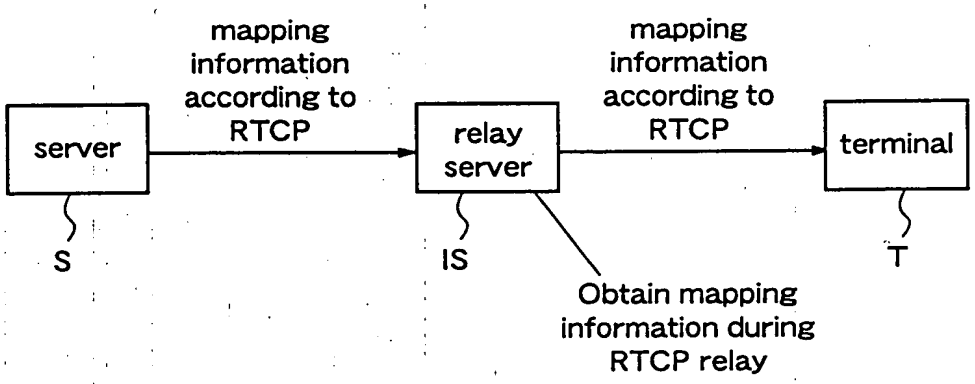

transmitting end
transmission delay measurement packet transmitting and receiving unit
62
61
63
transmitting end
allowable reproduction delay information receiving unit
allowable reproduction delay decision unit
21
23
transmitting end
receiving unit
packet decoding unit
208

Fig.27 (a)



t_s : server transmission time
t_r : terminal reception time
t_o : packet output time
t_p : time stamp of packet
(unit and initial value are identical to those of server transmission time and terminal reception time)
d_p : (allowable) reproduction delay
d_s : server-to-terminal transmission delay

Fig.27 (b)



Prior Art

Fig.28 (a)

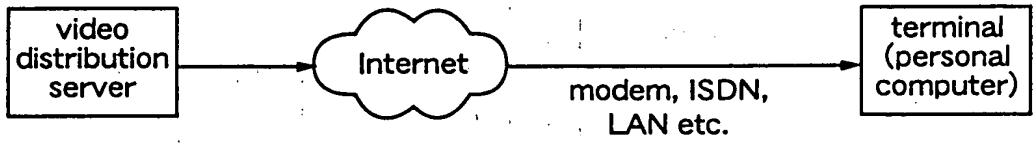


Fig.28 (b)

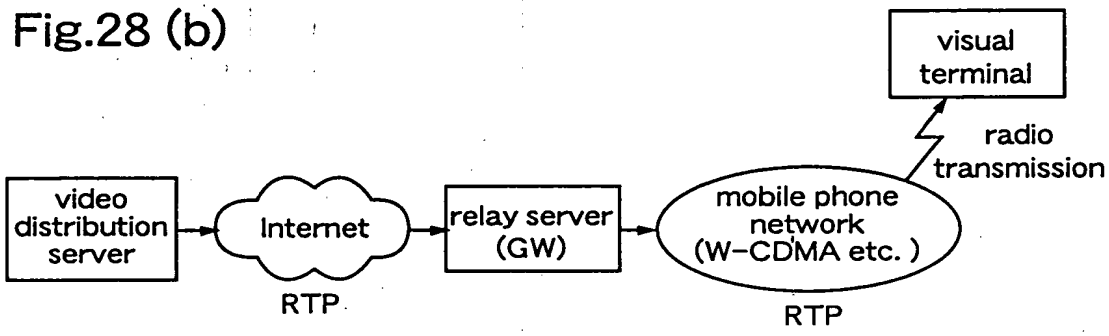


Fig.29 (a)

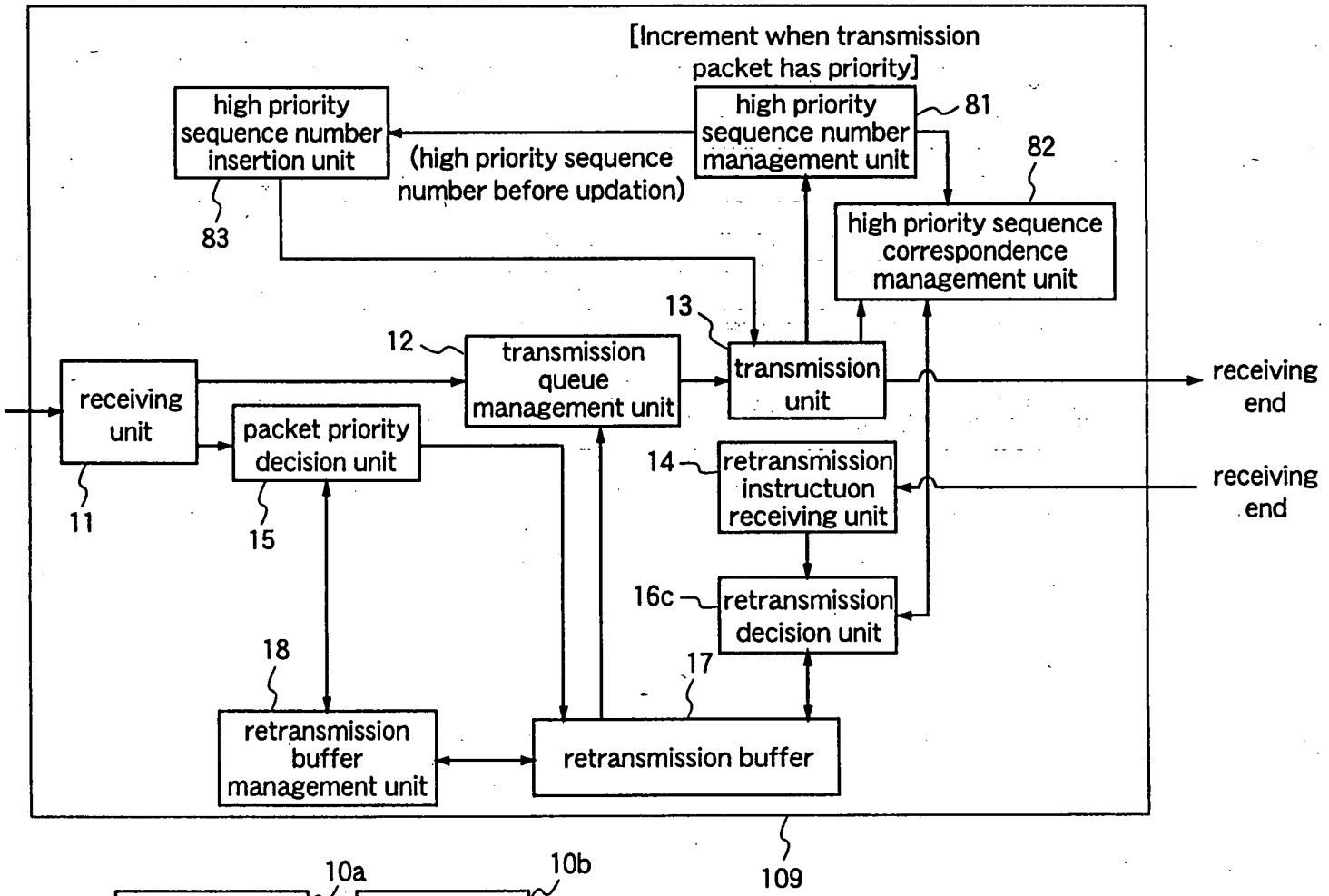


Fig.29 (b)

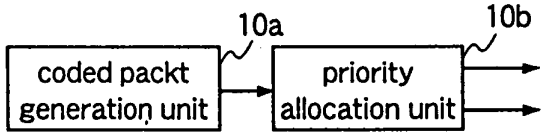


Fig.30

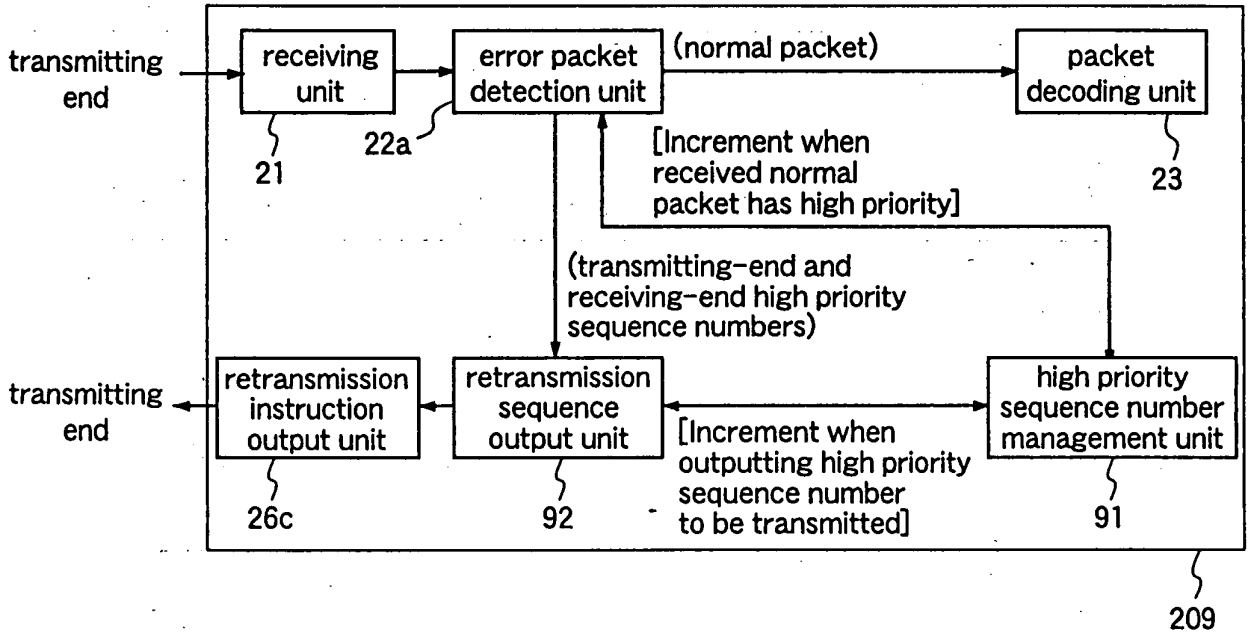

transmitting end
receiving unit
21
error packet detection unit
22a
(normal packet)
packet decoding unit
23
[Increment when received normal packet has high priority]
(transmitting-end and receiving-end high priority sequence numbers)
transmitting end
retransmission instruction output unit
26c
retransmission sequence output unit
92
[Increment when outputting high priority sequence number to be transmitted]
high priority sequence number management unit
91
209

Fig.31

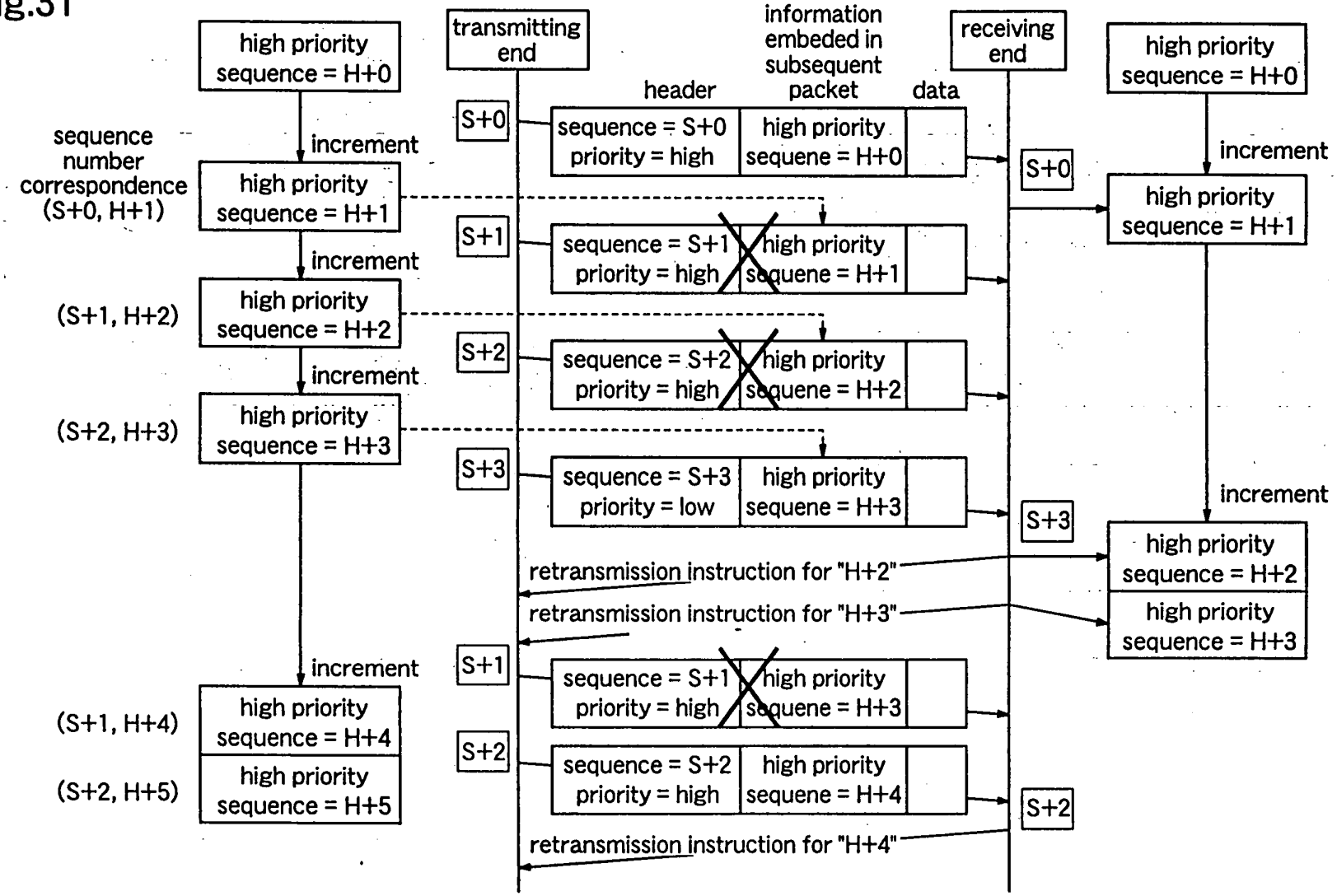

high priority sequence = H+0
transmitting end
information embeded in subsequent packet
receiving end
high priority sequence = H+0
header
data
S+0
sequence = S+0 priority = high
high priority sequene = H+0
S+0
increment
sequence number correspondence (S+0, H+1)
high priority sequence = H+1
S+1
sequence = S+1 priority = high
high priority sequene = H+1
high priority sequence = H+1
increment
increment
(S+1, H+2)
high priority sequence = H+2
S+2
sequence = S+2 priority = high
high priority sequene = H+2
increment
(S+2, H+3)
high priority sequence = H+3
S+3
sequence = S+3 priority = low
high priority sequene = H+3
S+3
increment
high priority sequence = H+2
retransmission instruction for "H+2"
retransmission instruction for "H+3"
high priority sequence = H+3
increment
S+1
sequence = S+1 priority = high
high priority sequene = H+3
(S+1, H+4)
high priority sequence = H+4
S+2
sequence = S+2 priority = high
high priority sequene = H+4
(S+2, H+5)
high priority sequence = H+5
S+2
retransmission instruction for "H+4"

Fig.32

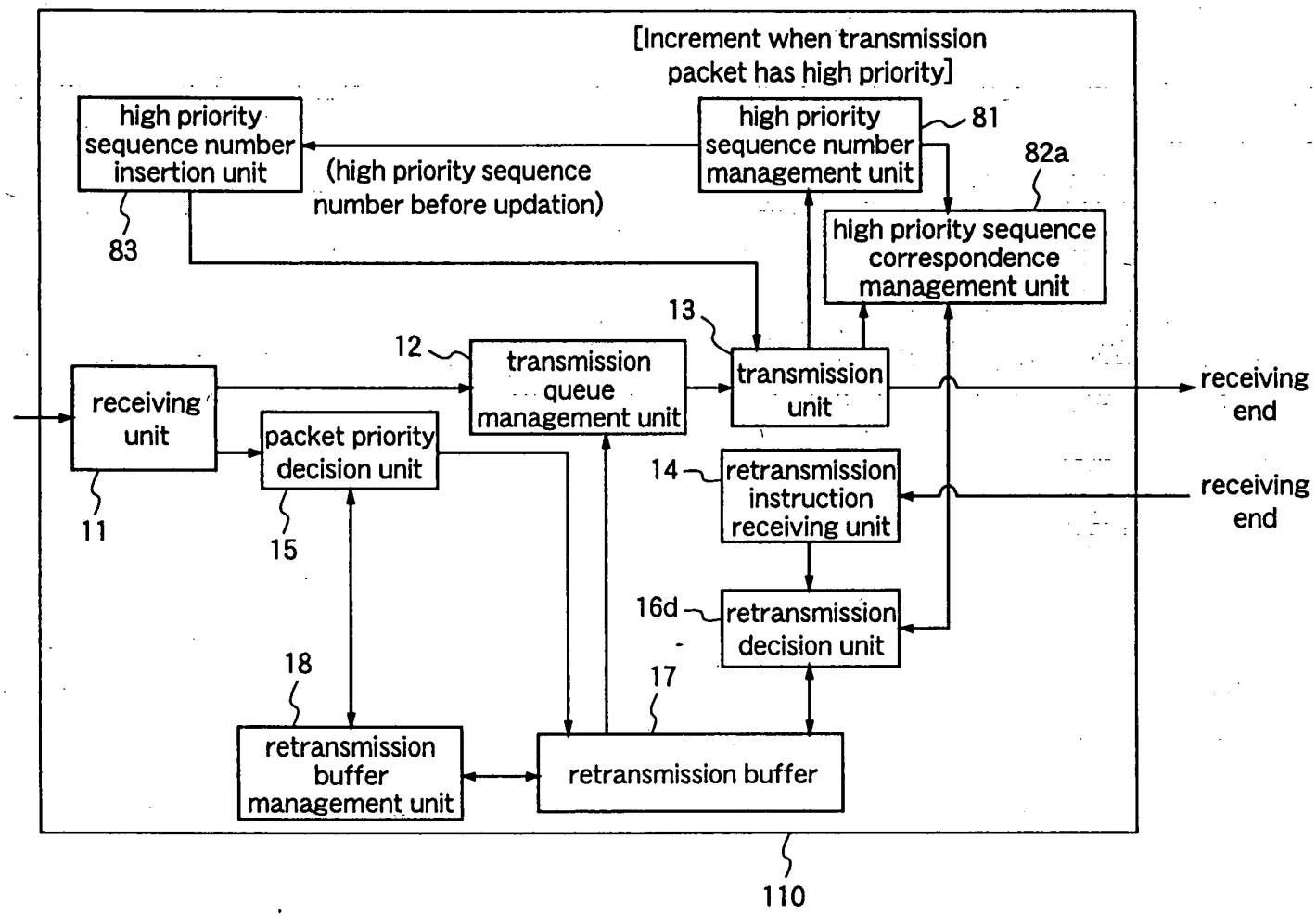

[Increment when transmission packet has high priority]
high priority sequence number insertion unit
(high priority sequence number before updation)
high priority sequence number management unit
81
82a
high priority sequence correspondence management unit
83
13
12
transmission queue management unit
transmission unit
receiving unit
packet priority decision unit
receiving end
receiving end
14
retransmission instruction receiving unit
11
15
16d
retransmission decision unit
18
17
retransmission buffer management unit
retransmission buffer
110

Fig.33

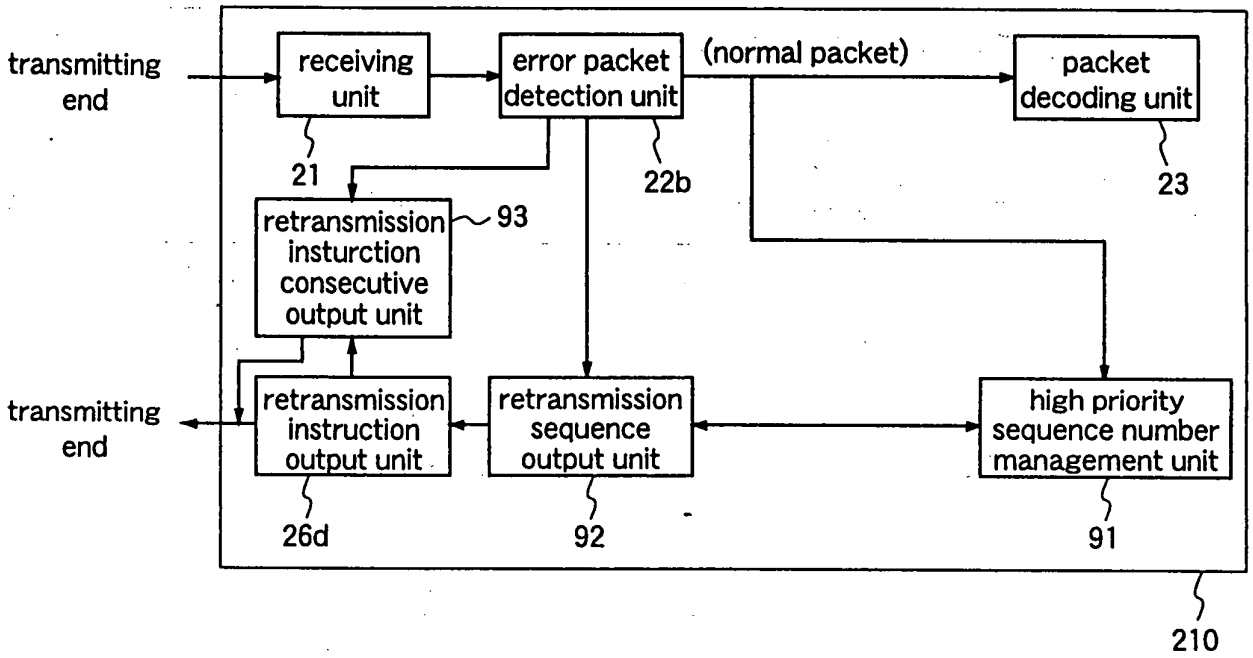

transmitting end
receiving unit
21
error packet detection unit
22b
(normal packet)
packet decoding unit
23
retransmission insturction consecutive output unit
93
transmitting end
retransmission instruction output unit
26d
retransmission sequence output unit
92
high priority sequence number management unit
91
210

Fig.34 (a)

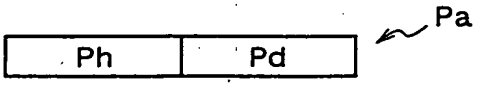


Fig.34 (b)

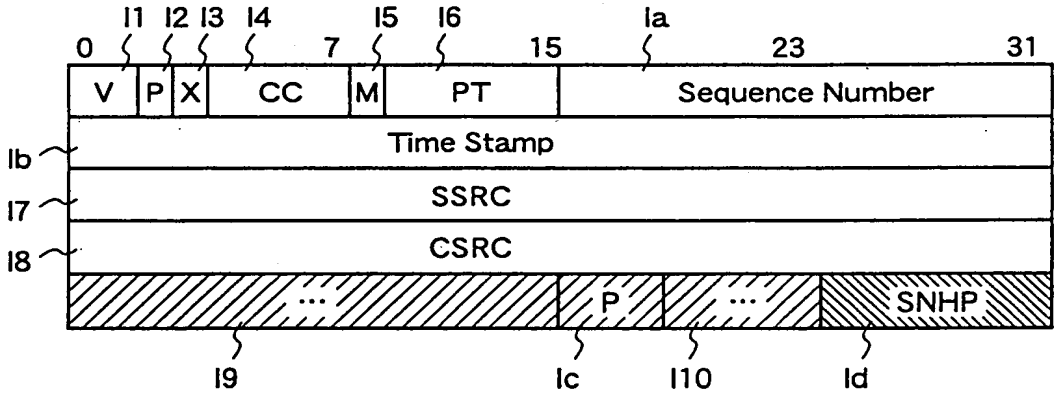


Fig.34 (c)

Field name	Number of bits	Description
V:Version	2	Please refer to RFC1889
P:Padding	1	Please refer to RFC1889
X:Extension	1	Please refer to RFC1889
CC:CSRC Count	4	Please refer to RFC1889
M:Marker	1	Please refer to RFC1889
PT:Payload Type	7	MPEG1, MPEG2 in Fig.35(b)
Sequence Number	16	Please refer to RFC1889
Time Stamp	32	Please refer to RFC1889
SSRC	32	Please refer to RFC1889
CSRC	32*CC	Please refer to RFC1889
P:Padding	3	Picture Type(I or P or B)
SNHP:Sequence Number of RTP packet with High Priority	6	